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DINSMORE & SHOHL LLP
ONE DAYTON CENTRE, ONE SOUTH MAIN STREET
SUITE 1300
DAYTON, OH 45402-2023

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PHAM, LONG	

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Application Number: 08/915,658
Filing Date: August 21, 1997
Appellant(s): TRIVEDI, JIGISH D

Susan Luna

For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 09/06/05 appealing from the Office action mailed 04/04/05.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The following are the related appeals, interferences, and judicial proceedings known to the examiner which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal:

Appeal No. 2002-0043.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,094,981	Chung et al.	03-92
4,910,578	Okamoto	03-90

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 31-35, 37, 41-45, and 48-49 are rejected under 35 U.S.C. 102(b) as being anticipated by Chung et al. (U. S. Pat. 5,094,981).

Regarding claim 31, Chung et al. discloses in Fig. 1e a local interconnect that comprises a composite structure comprising a first metal silicide *(38A, 38B as disclosed in col. 5, lines 20-33)*, a second metal silicide *(40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55)*, and an intermetallic compound *(36A, 36B as*

disclosed in col. 4, lines 55-57) reducing the resistance of the local interconnect, wherein the intermetallic compound comprises metal from the first metal silicide *(in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57)* and metal from the second metal silicide *(in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57)*, wherein the intermetallic compound *(36A, 36B)* contains no non-metallic materials.

Regarding claim 32, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide and the second metal silicide each comprise at least one refractory metal (titanium and tungsten).

Regarding claim 33, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide and the second metal silicide comprises titanium and tungsten.

Regarding claim 34, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 35, Chung et al. discloses in Fig. 1e a local interconnect for connecting a first active semiconductor region to a second active semiconductor region on a substrate assembly, the first and second active semiconductor regions being separated by an insulating region *(32)*, the local interconnect comprises a composite structure comprising a first refractory metal

silicide *(38A, 38B as disclosed in col. 5, lines 20-33)*, a second refractory metal silicide *(40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55)*, and an intermetallic compound *(36A, 36B as disclosed in col. 4, lines 55-57)* reducing the resistance of the local interconnect, wherein the intermetallic compound comprises refractory metal from the first refractory metal silicide *(in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57)* and refractory metal from the second refractory metal silicide *(in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57)*, the refractory metal from the first refractory metal silicide being different from the refractory metal from the second refractory metal silicide, and wherein the intermetallic compound *(36A, 36B)* contains no non-metallic materials.

Regarding claim 37, Chung et al. discloses in Fig. 1e a semiconductor device that comprises a substrate assembly having at least one semiconductor layer *(10)*; at least one field effect transistor *(22)* formed in the at least one semiconductor layer *(10)*, the at least one field effect transistor *(22)* having a source *(18)*, a drain *(18)*, and a gate *(22)*; and a local interconnect that comprises a composite structure comprising a first refractory metal silicide *(38A, 38B as disclosed in col. 5, lines 20-33)*, a second refractory metal silicide *(40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55)*, and an intermetallic compound *(36A, 36B as disclosed in col. 4, lines 55-57)* reducing the resistance of

the local interconnect, wherein the intermetallic compound comprises refractory metal from the first refractory metal silicide *(in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57)* and refractory metal from the second refractory metal silicide *(in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57)*, wherein the intermetallic compound *(36A, 36B)* contains no non-metallic materials.

Regarding claim 41, Chung et al. discloses in Fig. 1e a local interconnect that comprises a composite structure comprising a first metal silicide *(38A, 38B as disclosed in col. 5, lines 20-33)*, a second metal silicide *(40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55)*, and an intermetallic compound *(36A, 36B as disclosed in col. 4, lines 55-57)* reducing the resistance of the local interconnect, wherein the intermetallic compound comprises metal from the first metal silicide *(in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57)* and metal from the second metal silicide *(in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57)*, wherein the intermetallic compound *(36A, 36B)* contains no non-metallic materials. Regarding the limitation of "an intermetallic compound formed by a reaction between said first metal silicide and said second metal silicide", the "formed by " part of the limitation is not considered since the method of forming a device is not germane to the issue of

patentability of the device itself and since Chung et al. discloses the claimed structure. Therefore, this limitation has not been given patentable weight.

Regarding claim 42, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 43, Chung et al. discloses in col. 4, lines 55-57 that the intermetallic compound comprises titanium tungsten.

Regarding claim 44, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 45, Chung et al. discloses in col. 4, lines 55-57 that the intermetallic compound comprises titanium tungsten.

Regarding claim 48, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 49, Chung et al. discloses in col. 4, lines 55-57 that the intermetallic compound comprises titanium tungsten.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 36, 38-40 and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al. in view of Okamoto (U. S. Pat. 4,910,578).

Regarding claim 36, Chung et al. discloses that the composite structure that comprises the first metal silicide *(38A, 38B)*, the second metal silicide *(40A, 40B)*, and an intermetallic compound *(36A, 36B)* has a thickness of about 7000Å, since the second metal silicide *(40A, 40B)* is disclosed to have a thickness of 6000-12000Å.

Chung et al. does not disclose the composite structure having claimed range of a thickness of about 700Å to 1800Å. But it discloses a thickness for a local interconnect structure.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the thickness of the composite structure that forms the local interconnect as there is no statement denoting the criticality of the thickness and as the structure of Chung et al. provides a local interconnect structure with a low contact resistance while inhibiting the diffusion of the material to underlying layers.

"In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%."

The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.)" (MPEP 2144.04)

Regarding claim 38, Chung et al. discloses in Fig. 1e a semiconductor device that comprises a substrate assembly having at least one semiconductor layer *(10)*; at least one field effect transistor *(22)* formed in the at least one semiconductor layer *(10)*, the field effect transistor *(22)* having a source *(18)*, a drain *(18)*, and a gate *(22)*; and a local interconnect for connecting the source and drain of the field effect transistor to an active area, the local interconnect comprises a composite structure comprising a first refractory metal silicide *(38A, 38B as disclosed in col. 5, lines 20-33)*, a second refractory metal silicide *(40A, 40B as disclosed in col. 5, lines 50-66, and col. 7, lines 53-55)*, and an intermetallic compound *(36A, 36B as disclosed in col. 4, lines 55-57)* reducing the resistance of the local interconnect, wherein the intermetallic compound comprises refractory metal from the first refractory metal silicide *(in this case the first metal silicide is titanium silicide and the first metal is titanium as disclosed in col. 4, lines 55-57)* and refractory metal from the second refractory metal silicide *(in this case the second metal silicide is tungsten silicide and the second metal is tantalum as disclosed in col. 7, lines 53-55, and col. 4, lines 55-57)*, wherein the intermetallic compound *(36A, 36B)* contains no non-metallic materials.

Chung et al. discloses the claimed invention with the exception of teaching a memory array, and specifically disclosing what the local interconnect connects to.

Okamoto teaches in Fig. 4D an interconnect comprising a composite structure comprising a first metal silicide *(4)*, a second metal silicide *(8)*, and an intermetallic compound *(10)* comprising metal from the first metal silicide and metal from the second metal silicide; wherein the first metal silicide may comprise titanium silicide *(as disclosed in col. 4, l. 43)* and the second metal silicide may comprise tungsten silicide *(as disclosed in col. 6, l. 49-51)*, and the intermetallic compound *(10)* comprises titanium tungsten (TiW) *(as disclosed in col. 6, l. 64-66)*, and that the interconnect structure can be used in memory arrays, as memory arrays are well known to be LSI circuits and the structure of Okamoto is directed to LSI circuits.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the structure be a memory array, and that the interconnections taught by Chung et al. be used in such structures as the use of interconnections in a memory array is well known to one of ordinary skill in the art and as Okamoto discloses the use of local interconnects in LSI circuits.

Regarding claims 39 and 40, Chung et al. discloses in Fig. 1E a plurality of interconnects *(formed by layers 40B, 36B, 34B, and 38B; 40A, 36A, 34A, 38A; and so*

on) for connecting additional active areas *(18, 26, 30)* within the structure and to areas outside the structure.

Regarding claim 46, Chung et al. discloses in col. 5, lines 20-33 and in col. 7, lines 53-55 that the first metal silicide comprises titanium silicide and the second metal silicide comprises tungsten silicide.

Regarding claim 47, Chung et al. discloses in col. 4, lines 55-57 that the intermetallic compound comprises titanium tungsten.

(10) Response to Argument

In response to the appellant's arguments in the paragraphs on pages 5, 6, 7, and 8 and the paragraph bridging pages 9 and 10 of the Brief on Appeal dated 09/06/05, it is submitted that Chung et al. teach a composite structure comprising of a first metal silicide or titanium silicide 38A,38B (see col. 5, lines 20-22), a second metal silicide or tungsten silicide 40A, 40B (see col. 5, lines 60-65 and col. 7, lines 53-60) and an intermetallic compound 36A,36B comprises of metal of titanium from the first metal silicide and metal of tungsten from the second metal silicide (see col. 4, lines 55-60). Further, since claimed invention is directed to a structure it is submitted how the composite structure is formed has not been given patentable weight. Further, it is submitted:

A comparison of the recited process with the prior art process does not serve to resolve the issue concerning patentability of the product. In re Fessman, 489 F2d 742, 180 uspq 324 (CCPA 1974).

Where a product is patentable depends on whether it is known in the art or it is obvious, and is not governed by whether the process by which is made is patentable. In re Klug, 333 F2d 905, 142 uspq (CCPA 1964).

In an exparte case, product by process claims are not constructed as being limited to the product formed by the specific process recited. In re Hirao et al., 535 F2d 67, 190 uspq 15, see footnote 3 (CCPA 1976).

"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.". In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

The structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. See, e.g., In re Garnero, 412 F.2d 276, 279, 162USPQ 221, 223 (CCPA 1979).

In response to appellant's arguments in the paragraph bridging pages 8 and 9 of the Brief on Appeal dated 09/06/05, it is submitted that the appellant has the burden of proving the criticality of the claimed range. See MPEP 2144.05.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

conferees:

/Wael M Fahmy/
Supervisory Patent Examiner, Art Unit 2814

Ricky Mack
/Ricky L. Mack/
Supervisory Patent Examiner, Art Unit 2873

/Long Pham/
Primary Examiner, Art Unit 2814